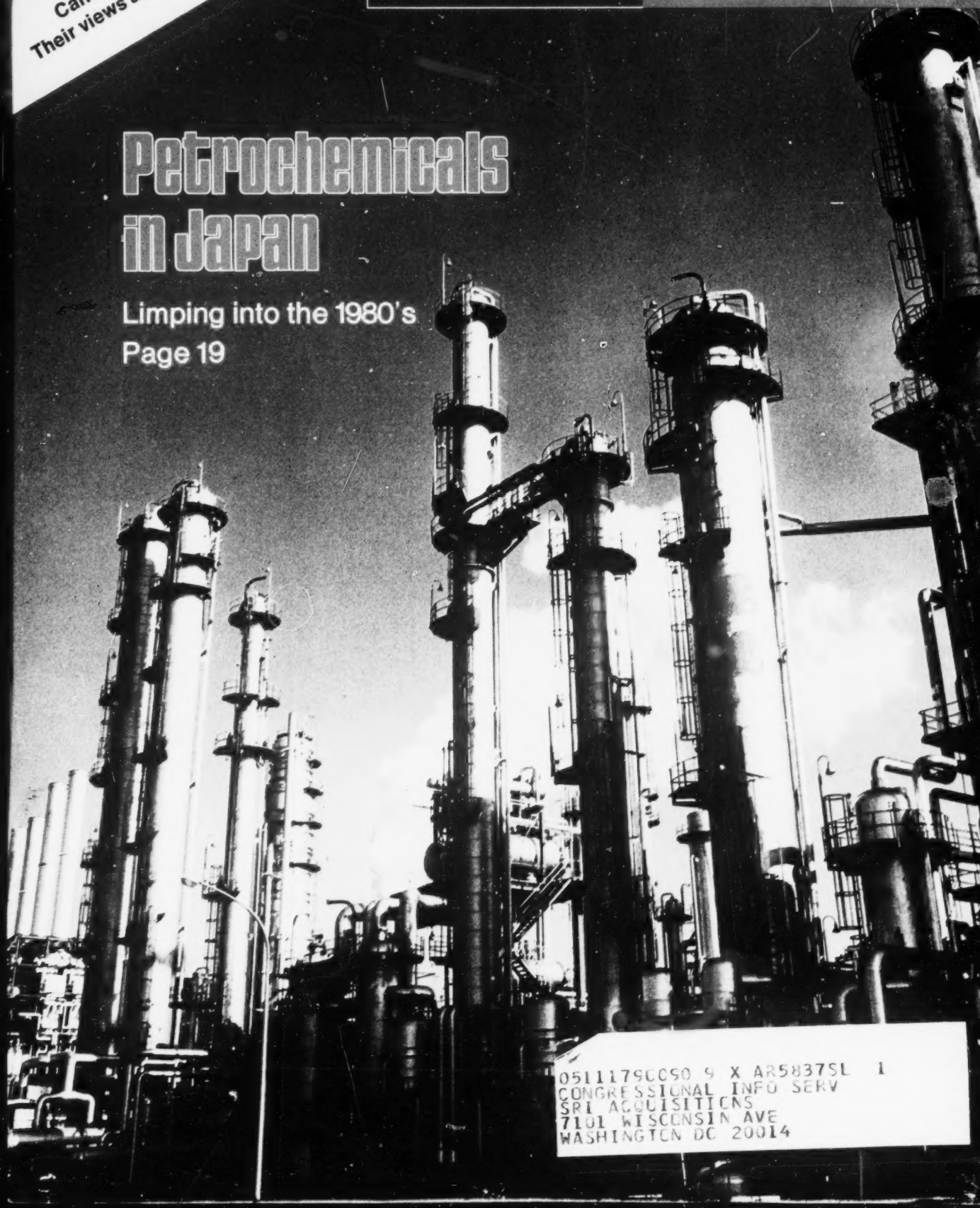
A1250-1

Chemical & Engineering NEWS
September 15, 1980

Candidates in ACS fall election
Their views and backgrounds Page 54

Petrochemicals in Japan

Limping into the 1980's
Page 19



051117900S0 9 X AR5837SL 1
CONGRESSIONAL INFO SERV
SRI ACQUISITIONS
7101 WISCONSIN AVE
WASHINGTON DC 20014

September 15, 1980
Volume 58, Number 37
CENEAR 58 (37) 1–80
ISSN 0009-2347

Chemical & Engineering NEWS

Cover: Sumitomo Chemical's Chiba works ethylene plant

2 Letters
3 Editor's Page

Concentrates
8 Business
25 Government
29 Science/Technology

The Departments
80 Newscripts

News of the Week

- ***House passes Technology Innovation Act,*** *begins hearings on controversial National Technology Foundation Act.* ***Page 4***
- ***OSHA suffers setbacks*** *in two cases involving workplace hazards.* ***Page 4***
- ***University of California, Berkeley,*** *faces loss of government contracts in Labor Department job discrimination suit.* ***Page 5***
- ***Corco files bankruptcy plan*** *that requires no outside investment.* ***Page 5***
- ***Fuel de-emphasized*** *in favor of animal feed at company operating process to convert feedlot manure.* ***Page 6***
- **R&D Mexico** *features news of science, technology for worldwide audience.* ***Page 6***
- ***Willard Libby,*** *Nobelist for work on carbon-14 dating, is dead at 71.* ***Page 6***

Business

- ***B. F. Goodrich's chemical sales growing;*** *are expected to be nearly half of company's sales by 1990.* ***Page 17***

International

- ***Japan's petrochemical industry*** *faces hard times, slim profitability as production drops, inventories mount.* ***Page 19***

Government

- ***Donald Tower,*** *director of NIH's neurological and communicative disorders division, guides U.S. neuroscience effort.* ***Page 26***
- ***Risk reduction as a regulatory goal*** *is questionable, analyst says.* ***Page 28***

Science

- ***Advances from the chemical congress:*** *route to neutron-rich nuclides, findings in state-to-state chemistry, syntheses for alkaloids and lactones, electricity-conducting inorganic polymer, dichlorobenzene process, designing safer drugs, gamma emitters for tumor study, amine protection and fluoroalkylating reagents, vitamin C, and polynuclear aromatics in the environment.* ***Page 30***

Technology

- ***Also from the Las Vegas congress:*** *oil shale retorting process, hydrocarbons from plants, aid to radiotracer synthesis, and emulsion polymerization control.* ***Page 42***

Books

- ***David Lygre's*** *"Life Manipulation: From Test-Tube Babies to Aging" raises ethical questions on new biology.* ***Page 47***

ACS News

- ***ACS Council*** *terminates experimental commissions, approves two petitions at meeting in Las Vegas.* ***Page 49***

ACS Election

- ***Candidates for 1981 president-elect,*** *director-at-large, region II and VI directors give views on society affairs.* ***Page 54***

Petrochemicals in Japan face troubled future

Skyrocketing raw materials costs and fierce competition among firms lie behind poor profitability that continues to plague Japanese producers

Earl V. Anderson
C&EN, New York

Petrochemical industry executives in Japan are looking ahead to the future and finding that the future is now.

Since late spring, the industry has fallen upon rough times. Production has been dropping and continues to drop. Inventories are building up. The consequences soon will start showing up in less-than-attractive profit and loss statements.

What is happening to Japan's petrochemical industry, and what has been happening for the past four or five months, is a startling reversal of the production records and profit improvements that Japanese petrochemical companies had been racking up over the previous 18 months. Welcome changes for the better started sifting through the entire industrial structure starting in late 1978. The improvements continued throughout 1979.

Industry leaders welcomed 1980 with confidence and optimism, although, to be sure, some of that optimism was guarded. For the first few months of the year, the optimism seemed justified.

Then, just as it seemed as if the Japanese petrochemical industry finally was overcoming the effects of the 1973 oil shock, its fortunes took a nosedive. It soon became apparent that the effects of that seven-year-old oil crisis are still there. It also has become apparent that the production records set during those heady days of late 1978 and 1979 weren't really indicative of true demand.

The outlook for the remainder of the calendar year and for the fiscal year, which for most Japanese companies ends in March 1981, isn't particularly encouraging. There now are very few optimists to be found in the petrochemical industry's executive suites.

Whatever improvement, if any, that may come to Japan's petrochemical industry over the next three to six months will be gradual. And it will be slight. At press time, Japan was scheduled to unveil a new economic package designed to stimulate an economy that shows unmistakable signs of slowing down. Depending on what is in that package, it could help some. But most of Japan's petrochemical leaders are realistic enough to know that government's economic stimuli take time to filter down to their industry.

As a result, the next three to six months will be critical ones for the country's petrochemical industry. The problems that it faces and the way that it handles them will be watched carefully, because they will be the same problems the industry must solve over the next 10 to 15 years if it is to survive.

That is no exaggeration. More than one analysis of the petrochemical industry's future is laced with phrases such as "bracing itself for the arrival of a new era," "faced with the stark issues of survival," and "difficulties . . . threaten its very existence."

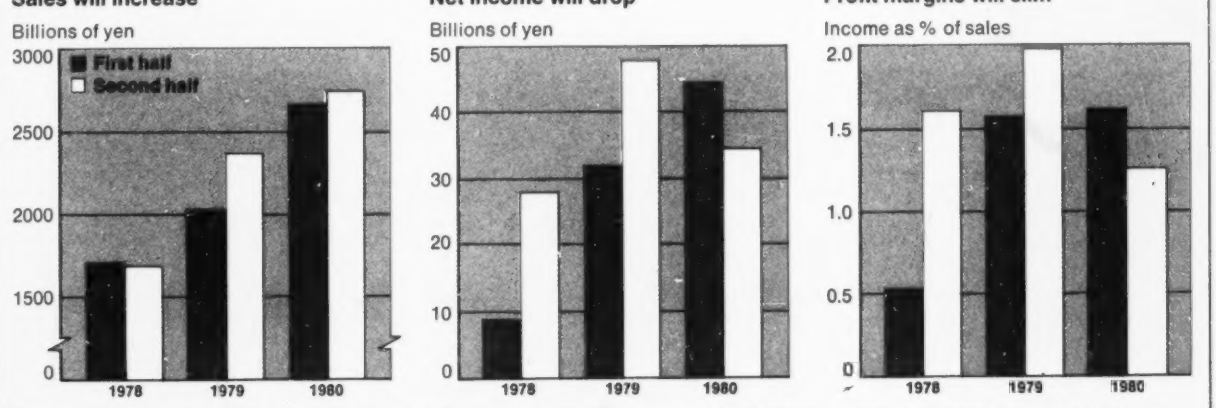
At the head of the problem list is profitability—or lack of it. Historically, Japanese petrochemical companies always have had slimmer profit margins than their U.S. or European counterparts.

Profit margins and profits took a quantum leap upward during late 1978 and 1979. Despite the improvement, however, a U.S. chief executive wouldn't find them much to brag about.

Now, even that recovery seems to be short-lived. It's all but certain that profits for most Japanese petrochemical companies will tumble in the second half of fiscal 1980.

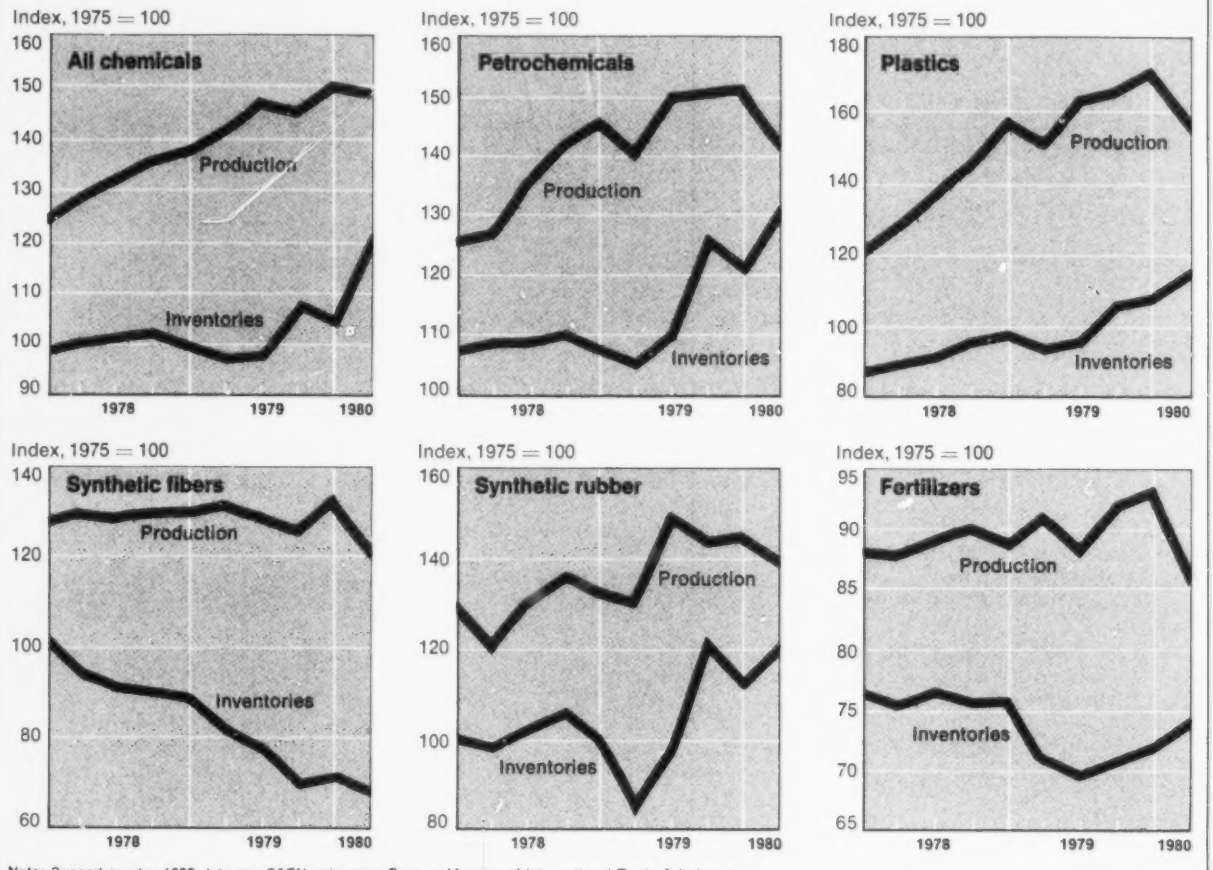
Most of the industry's other prob-

For Japanese petrochemical firms this year:



Note: Six-month data are for fiscal years ending March 31. Based on results and estimates of 10 leading Japanese petrochemical companies—Mitsubishi Chemical Industries, Sumitomo Chemical, Asahi Chemical Industry, Toray Industries, Mitsui Toatsu Chemicals, Teijin, Showa Denko, Mitsubishi Petrochemical, Dainippon Ink & Chemicals, and Sekisui Chemical. **Source:** Toyo Keizai Shinposha

Japanese chemicals: Production is declining, inventories rising in most areas



Note: Second-quarter 1980 data are C&EN estimates. **Source:** Ministry of International Trade & Industry

lems are the rocks that weigh down profitability. Chief among them is raw material supply and price.

Japan's petrochemical industry is based primarily on naphtha, much of which is imported. That which is produced domestically relies on imported crude oil. And it is no secret that, until very recently, imported naphtha and crude prices have skyrocketed in Japan.

Although Japanese petrochemical companies have had to shoulder much higher raw material costs, they have had trouble passing those costs along to their customers. Even when they were able to make higher prices stick, the increases didn't keep pace with costs.

The reasons differ from time to time. On occasion, it's simply been a case of too much capacity and too little demand. Even when demand was there, prices didn't go up so much as they should have.

That's because, contrary to some popular opinion in the U.S., competition among Japanese petrochemical producers is fierce. The industry is made up of a large number of fairly small competitors.

Last year's sales of Mitsubishi Chemical Industries were about $2.5 billion. Now Mitsubishi is the largest petrochemical company in Japan, yet its sales last year pale alongside those of Hoechst's $15.6 billion, the $15 billion of Bayer and BASF, or Du Pont's $12.6 billion.

With many small competitors slugging it out in the marketplace, competition is bound to be fierce. Petrochemical prices reflect this ferocity. Many Japanese chemical companies routinely cut prices or refuse to raise them to grab a small additional slice of the market. Corporate profits in Japan's petrochemical industry testify to it.

Higher raw material costs are starting to take their toll on the industry's prowess in international trade. Japan's petrochemical industry has enjoyed a favorable balance of trade for many years. It still does, and probably always will.

But the task is becoming more difficult. U.S. companies, with their feedstock advantage, are squeezing Japanese petrochemical companies out of their cherished Southeast Asian market.

Meanwhile, new and formidable competition is springing up in Asia itself. Taiwan and the Republic of South Korea are on the road to self-sufficiency in petrochemicals. In several other Asian nations, petrochemical projects are being built. Meanwhile, additional contenders for international markets are shaping up in the oil-rich countries of the Middle East and in other developing nations as well.

While Japanese companies are finding it more difficult to export, they are finding it increasingly necessary to import. Through the first four months of the year, they imported almost $2 billion worth of chemicals, 28% more than during the same period last year. During the same period exports increased too, of course, but not so much.

As if these problems weren't enough to cope with, Japanese petrochemical companies face additional troubles at home. Land is extremely scarce in Japan. Most of the attractive industrial sites already have been exploited. To expand, or to replace old, inefficient plants with new ones, Japanese companies will have to

employ scrap-and-build tactics on existing sites.

Now, just when Japan's petrochemical industry is facing one of its severest tests, it no longer can regard itself as one of government's favorite and coddled industries. There was a time when it was.

During the early stages of its growth, the industry received protection and support from the government and from financial circles as well. It received investment funds at low interest rates, special depreciation rates, and, in some cases, tax forgiveness. It received preferential treatment to obtain foreign technology.

All of these crutches have long since been taken away from the petrochemical industry in Japan. Says Hisashi Kurokawa, president of Mitsubishi Petrochemical, "The petrochemical industry, which was once lionized as a strategic industry, has come to be regarded as an industry that produces pollution as well as consumes a huge amount of energy."

Recently, Norishige Hasegawa, chairman of Sumitomo Chemical, is reported to have said, "MITI [Ministry of International Trade & Industry] claims that my industry is structurally depressed. That's not true. We are politically depressed."

Hasegawa's comment was made during negotiations between industry and government over naphtha prices. And if there is one overriding factor that is causing Japanese petrochemical companies to lose their competitive edge at home and abroad, it is naphtha—its supply and its price.

Starting in late 1976, as the world market price became more attractive vis-a-vis domestic naphtha, Japanese ethylene producers turned increasingly to imports. In less than a two-year period in 1977–78, imported naphtha's share of all the naphtha consumed in Japan rose from 34% to 40%.

Prices that Japanese petrochemical companies paid for imported naphtha bottomed out in the fall of 1978 at about 18,000 yen per kiloliter, then seemed to stabilize at about 21,000 to 24,000 yen per kiloliter (about $84 to $96). This still was some 20 to 25% less than domestic refiners were charging in Japan.

Then, says one Japanese chemical executive, "all hell broke loose." Prodded by the turbulence in Iran, naphtha prices on the spot market skyrocketed. Japanese naphtha importers were forced to accept several price increases in their long-term contracts.

The average price that Japanese petrochemical companies paid for their imported naphtha doubled last year. By year's end, they were paying about 50,000 yen per kiloliter or about $40 per bbl.

For Japanese petrochemical companies, domestic naphtha had become less expensive than imported material, despite Japanese refiners' paying much higher prices for their imported crude. But domestic naphtha could supply only half of Japan's requirements. As a result, Japanese petrochemical companies were stuck with expensive imported naphtha.

The industry found itself locked into this uncomfortable naphtha situation just as it was about to take off on a production binge. Starting in the fourth quarter of 1978 and continuing through all of last year, output of most major petrochemicals soared in Japan.

In 1978, thanks to a surge in the third and fourth quarters, ethylene production hit 4.4 million metric tons, 10% higher than in 1978. It marked the first time that ethylene output in Japan topped 4 million metric tons since 1974. Last year, ethylene production jumped another 9% to a record 4.8 million metric tons. By the fourth quarter of 1979, ethylene producers were operating at close to a 5 million metric-ton annual rate.

In aromatics, the trend was the same. 1979 production of benzene was up 8%, toluene 7%, and xylenes 5%.

In fact, all along the petrochemical product chain, there were indications that Japanese petrochemical companies finally were starting to breathe the fresh air of recovery following a recession that started in 1975. Demand increased for most products. Output surged to meet the demand.

Overall, production of petrochemicals in Japan rose 10.4% last year. Plastics output led the pack with a 20% increase. Synthetic rubber production increased 8%. Only fibers and chemical fertilizer remained relatively static.

More important than its resurgence in production, the Japanese petrochemical industry was able to raise prices during this period—and make them stick.

This resurgence in prices was a welcome change for petrochemical companies. Throughout most of 1978, petrochemical prices declined for a combination of reasons. Negotiations between petrochemical companies and refiners over naphtha price were deadlocked for a long time. Customers, anticipating a drop in domestic naphtha prices, resisted industry attempts to raise prices.

Besides, demand wasn't particularly brisk at the time. It didn't start picking up until the latter part of the year. On the supply side, output from two new ethylene plants (one came on stream in the summer of 1977 and the other in the spring of 1978) had to compete for a share of a still stagnant market.

Until the round of price increases last year, prices on Japan's chemical market were so low—and so unprofitable—that they were known throughout the industry as "sunken prices." Last year's price increases lifted the industry out of the sunken price stage, but it still has a long way to go to achieve an adequate pricing structure.

Increased demand and higher prices did, however, enable Japanese chemical companies to improve their profit picture. In fiscal 1979, combined sales of the 10 largest Japanese chemical companies hit 4381 billion yen (about $18.3 billion), which was a welcome 27% higher than the preceding year.

But sales alone don't tell the whole story. Starting in the second half of fiscal 1978 (that is, from September 1978 to March 1979), the net income of these 10 largest companies improved significantly. For instance, in the five previous fiscal half-years, their net income never exceeded 10.4 billion yen and had been as low as 4.3 billion yen.

However, in the second half of fiscal 1978, their net income jumped to 27.7 billion yen and it continued soaring to 31.9 billion and 47.5 billion in the first and second halves of fiscal 1979.

In all, net income of the top 10 Japanese chemical companies tripled in fiscal 1978 to 36.2 billion yen. It more than doubled again in the past fiscal year to 79.4 billion yen.

Along with this improvement in net income came an equally impressive improvement in profit margins. In fiscal 1976 and 1977, the profit margins of the 10 companies were about 0.3% and 0.4% of sales. In fiscal 1978, however, they were able to boost their profit margin to an average 1.05%. They raised it again last year to 1.81%, hardly an ecouraging figure compared to Dow's 8.5% or Du Pont's 7.5%, but a step in the right direction nonetheless.

Last year's performance of Sumitomo Chemical is typical of many chemical companies in Japan. In fiscal 1979 (which for this industry giant ended on Dec. 31), Sumitomo's sales increased 26.6% to 551 billion yen ($2.3 billion). However, it managed to increase net income a whopping 18% to 11 billion yen ($47 million).

In reality, the marketplace fortunes of Japanese petrochemical companies in 1979 are turning out to be an all-too-temporary mirage. Certainly, petrochemical demand was there in

Aminocyclitol Antibiotics

ACS Symposium Series No. 125

Kenneth L. Rhinehart, Jr., *Editor*
University of Illinois

Tetsuo Suami, *Editor*
Keio University

Based on a symposium jointly sponsored by the Divisions of Carbohydrate Chemistry and Medicinal Chemistry of the American Chemical Society.

This 22-chapter volume deals with the current status of structural, synthetic, and biosynthetic studies of animocyclitol antibiotics — one of the hottest current areas of research today!

Ongoing research on this group of antibiotics is resulting in new insights into the mechanisms of action and inactivation of aminocyclitols and the development of new, less toxic compounds. Following an introductory chapter discussing the members of this class of compounds, the book is divided into three sections.

CONTENTS

The first section covers synthetic studies and includes preparations and modifications of neomycin B, branched-chain aminocyclitols, neamine, kanamycins, gentamicins, and spectinomycins. The second section concentrates on structural studies of compounds such as the fortimicins — aminocyclitols with a 1,4-diamino substitution. C-13 NMR spectra, used to identify aminocyclitol structure, are included.

The final section of the book deals with biochemical studies of aminocyclitols. Topics include the use of mutants to prepare new antibiotics, interactions of aminocyclitols with ribosomes, and the multiple mechanisms of action of aminocyclitol antibiotics as well as the mechanisms by which target bacteria enzymatically inactivate these compounds. The synthesis and mutasynthesis of pseudosaccharides related to aminocyclitol-glycoside antibiotics, and the chemical and biological modification of antibiotics of the gentamicin group also are discussed.

437 pages (1980) Clothbound $39.50
LC 80-10502 ISBN 0-8412-0554-X

Order from:
SIS Dept. Box 12
American Chemical Society
1155 Sixteenth St., N.W.
Washington, D.C. 20036
or CALL TOLL FREE 800-424-6747
and use your credit card.

1979 and the industry went all out to meet it. But industry leaders now realize that what they really were meeting was an increase in "false demand."

With naphtha prices and petrochemical prices rising rapidly, customers went on a purchasing binge to build up their inventories in anticipation of still higher prices to come.

At the beginning of this year, confidence still oozed out of petrochemical company boardrooms. And for the first few months of the year, developments seemed to justify that confidence.

During the first quarter of 1980, the petrochemical production index averaged 152.9 (1975 = 100). In April, it hit 153.9. Both are higher than the strong third and fourth quarters of 1979.

According to production indexes compiled by MITI, output of plastics, synthetic fibers, synthetic rubber, and chemical fertilizer in this year's first quarter all exceeded that of the previous quarter.

During that first quarter, Japan's ethylene producers managed to turn out 1.2 million metric tons of product, just shy of the 1.4 million metric tons produced in the previous quarter.

Shortly after that, however, the mirage disappeared and reality set in. Ethylene production, a reasonably good leading indicator of Japanese petrochemical fortunes, started dropping.

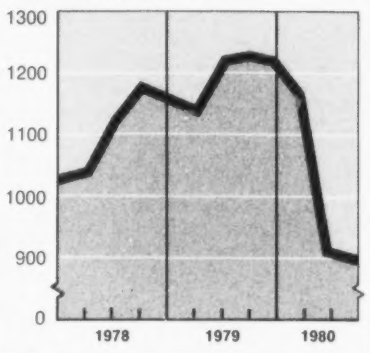
In the second quarter of 1980, ethylene output fell to 1.17 million metric tons, down 4.3% from the first quarter. Complete figures aren't in yet, but ethylene production in the July-September period probably will weigh in at around 915,000 metric tons, another 22% drop.

Unless the government's economic measures help quickly, ethylene producers probably will lower output slightly in the fourth quarter of the year. At best, it won't go up very much.

Production cutbacks are percolating throughout the entire industry. Kashima Vinyl Chloride Monomer Co., the largest producer of vinyl chloride in Japan, shut down one of its two lines recently. It probably still is operating at 50% of capacity. Earlier, other vinyl chloride producers cut production an average 30% and further cutbacks seem inevitable.

Demand for high-density polyethylene in the third quarter has been revised downward from its original 146,000 metric tons to a lower 140,000 metric tons. In the last quarter, observers estimate that demand will be 7 to 8% lower than in the last quarter of 1979. Nippon Petrochemicals has shut down its plant as a result.

Japanese ethylene output is turning down



Note: Third and fourth quarters of 1980 are estimates. **Source:** Ministry of International Trade & Industry

Lower demand and production cutbacks can be found everywhere throughout the plastics and fiber industries. The same is true for the intermediate petrochemicals that feed them. Now, MITI is talking to aromatics producers to see what can be done to improve a deteriorating supply-demand situation.

Not surprisingly, this turn of events has made it difficult for petrochemical companies to raise prices further. In fact, instead of pushing hard for price increases, companies are fighting requests for price cuts.

Ethylene producers are being hounded by derivatives producers to set "special" lower prices for ethylene that is used to produce chemicals for export. That's because, not only has the domestic market turned sluggish, but exports, particularly to Southeast Asia, have been hurt by competition from the U.S.

The consequences of the deteriorating petrochemical situation in Japan are easy to foretell. Profits are going to take another beating.

Based on data compiled by Toyo Kelzai Shinposha, C&EN estimates that the net profit of Japan's 10 largest chemical companies will drop to 34.4 billion yen in the second half of fiscal 1980 ending next March.

Average profit margins will slip to 1.26% of sales from the 2.0% that they were in the second half of 1979.

Nomura Research Institute figures confirm the trend, if not the exact numbers. Based on a survey of 29 Japanese chemical companies, the institute estimates that industry profits will drop 18% in the reporting period that ends this month. And they will go down another 3% in the second half of fiscal 1980.

Japanese petrochemical executives aren't naive enough to believe that last year's production and profit spurt

spelled an end to all of their problems. But the few who may have been lulled into a false sense of complacency have been shaken out of it by what's happening to Japan's petrochemical industry now.

The problems still exist. They still must be solved. And the raw material situation stands high on the list.

With ethylene and other chemical production curtailed, Japanese chemical companies find themselves in the unfamiliar position of having excess naphtha. Japanese refiners can't cut naphtha production any further. This means that chemical companies have stopped importing naphtha on a spot basis and are postponing deliveries due under long-term contracts. The irony of all this is that domestic naphtha now is more expensive than imported naphtha.

But chemical producers know that excess naphtha won't always be the order of the day. In past periods of shortage, chemical companies have switched part of their production to liquefied natural gas, butane, and propane.

That's one solution, but it's only a partial solution. Over the long haul, petrochemical feedstock in Japan will be characterized by a trend to heavy liquids.

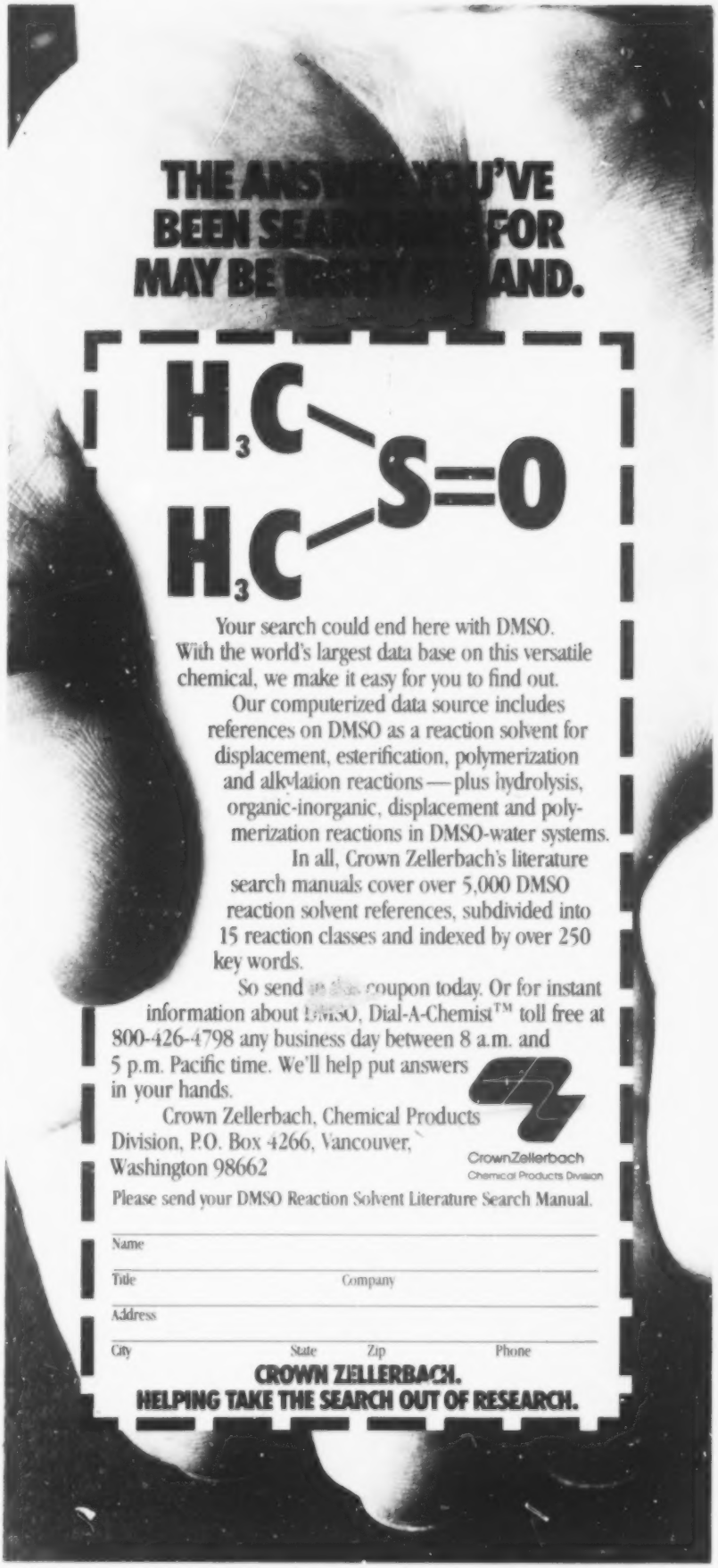
MITI has organized a petrochemical industry raw materials problem committee to analyze the supply-demand situation both in Japan and overseas. The committee also will examine possible approaches to fuel switching and feedstock diversification.

Meanwhile, the industry will be watching carefully progress of the so-called "C_1 project." Individually, several Japanese chemical companies have been looking into C_1 chemistry. But now, 14 companies are joining with Sagami Chemical Research Center to form a research association. Its goal is to develop the technical know-how necessary to use carbon monoxide as a raw material for chemicals.

Before the association was formed, MITI already had obtained a budget appropriation to promote the C_1 project as a major, national undertaking. Plans call for developing technology to make acetic acid, ethylene glycol, olefins, and alcohol.

Another raw materials option is to build plants in other countries, where raw materials are abundant. Japanese chemical companies are pursuing this option with a vengeance. Major petrochemical complexes are under way or planned in Singapore, Iran, and Saudi Arabia.

Ground-breaking ceremonies for the Singapore project took place in


THE ANS U'VE
BEEN SE FOR
MAY BE AND.
H3C
S=O
H3C
Your search could end here with DMSO.
With the world's largest data base on this versatile chemical, we make it easy for you to find out.
Our computerized data source includes references on DMSO as a reaction solvent for displacement, esterification, polymerization and alkylation reactions — plus hydrolysis, organic-inorganic, displacement and polymerization reactions in DMSO-water systems.
In all, Crown Zellerbach's literature search manuals cover over 5,000 DMSO reaction solvent references, subdivided into 15 reaction classes and indexed by over 250 key words.
So send in the coupon today. Or for instant information about DMSO, Dial-A-Chemist™ toll free at 800-426-4798 any business day between 8 a.m. and 5 p.m. Pacific time. We'll help put answers in your hands.
Crown Zellerbach, Chemical Products Division, P.O. Box 4266, Vancouver, Washington 98662
CrownZellerbach
Chemical Products Division
Please send your DMSO Reaction Solvent Literature Search Manual.
Name
Title
Company
Address
City
State
Zip
Phone
CROWN ZELLERBACH.
HELPING TAKE THE SEARCH OUT OF RESEARCH.

Fill a Staff Position on Capitol Hill

Two ACS Congressional Fellowships Available To Begin Fall 1981

The objectives of the fellowship program are:

- To provide an opportunity for scientists to gain firsthand knowledge of the operations of the legislative branch of the federal government,
- To make available to the government an increasing amount of scientific and technical expertise, and
- To broaden the perspective of both the scientific and governmental communities regarding the value of such scientific-governmental interaction.

Applications should be submitted by January 30, 1981 to:

Dr. Annette T. Rosenblum
Department of Public Affairs
American Chemical Society
1155—16th St., N.W.
Washington, D.C. 20036

Applications consist of a letter of intent, resume, and two letters of reference. The letter of intent should include a description of the applicant's experience in public-oriented projects in which scientific or technical knowledge was used as a basis for interaction and a statement that tells why they have applied for the Fellowship and what they hope to accomplish as an ACS Congressional Fellow. The resume should describe the candidate's education and professional experience and include other pertinent personal information. Letters of reference should be solicited from people who can discuss not only the candidate's competence but also the applicant's experience in public-oriented projects. Arrangements should be made to send the letters of reference directly to ACS.

For further information call (202) 872-4383.

July. Officially, it is known as PCS—Petrochemical Corp. of Singapore. An ethylene producer that will be able to turn out 300,000 metric tons a year by late 1982, PCS is owned equally by Singapore and Japan. But it is mainly a Sumitomo project, with leadership provided by Sumitomo Chemical, Sumitomo Corp., and Sumitomo Bank.

Assured naphtha supplies will come from Esso, Shell, and Singapore Petroleum refineries. Meanwhile, PCS will give birth to many downstream ventures, including plants to make low- and high-density polyethylene, polypropylene, ethylene glycol and oxide, and acetylene.

About 70% of the complex's output will be exported to Southeast Asia. This, of course, will affect Japan's own exports of petrochemicals to the region.

Work is just starting to resume on the oldest of the three major overseas projects. This is the Bandar Shaphur complex (since renamed Bandar Khomeini) in Iran. Proposed in 1968 and with construction started in 1971, the complex still is only 85% complete.

For the past year and a half, the project has gone untouched because of the political turmoil in Iran. But the Iranian government has been pushing Japan to resume the project.

Five major Japanese investors—Mitsui & Co., Mitsui Toatsu, Mitsui Petrochemical, Toyo Soda, and Japan Synthetic Rubber have agreed to do just that. The five hold equity shares in Iran Chemical Development Co., the Japanese partner with Iran in the $3.3 billion project.

At the center of the complex will be a 300,000 metric-ton-per-year ethylene plant. Parts of the plant already built have deteriorated and no one is really certain just when the project will start operating.

The third offshore project is in Saudi Arabia. Right now, only a feasibility study is under way, and that won't be completed until next year. Only then will final details for the project be worked out.

If the study shows that the project can fly commercially, construction of the ethylene unit might start later in 1981. The project will be a joint venture between Saudi Arabian Basic Industries Corp. and 54 companies of the Mitsubishi group.

Already, the partners have agreed to increase targeted capacity of the ethylene plant from its original 300,000 metric tons annually to 450,000 metric tons. The complex, which will include the usual cadre of downstream units, will be built at Al Jubail.

All three projects, in Singapore, Iran, and Saudi Arabia, are "national projects," promoted and heavily financed by the Japanese government. The government has its own reasons for promoting them. With Singapore, it was to mend political and economic fences in Southeast Asia. The Iranian and Saudi projects are meant to secure a stable supply of crude oil for Japan.

For its petrochemical industry, however, these projects mean something else. They mean that petrochemical companies will have to alter the way they do business.

Many of the petrochemicals that Japanese companies export to Southeast Asia and to other markets as well will be supplied from these offshore plants. These plants also will be shipping sizable volumes of basic and intermediate chemicals back to Japan.

What this means is that, in Japan, additional capacity and production of basic and intermediate chemicals will grow very slowly in the future. Much of the new capacity that will be added will be to replace antiquated and inefficient units.

It also means that Japanese companies will have to realign their product mix. The emphasis will go toward products that are more sophisticated technically and that have a higher value-added content.

That's the design of many Japanese chemical companies with an eye toward improved profits. The trend already is under way. Teijin, for instance, hopes to expand its engineering plastics business 20% per year. Mitsui Petrochemical Industries and Honshu Chemical recently agreed to launch a joint project to develop more valuable products based on phenol, aniline, and cresol.

Sumitomo's Hasegawa says that Japan's chemical industry has to depend upon proprietary technology based on its own research to survive. "The days have passed," says Hasegawa, "for the chemical industry to achieve its growth by mass production of commodity products."

He is right, of course. But Japan's petrochemical industry has to do even more. The industry is fragmented, with many companies that are smaller than their U.S. or European counterparts. Marketing power is much lower.

It has to restructure itself. But that is easier said than done. In its study of industry's problems, the Japan Chemical Industry Association points out that the number of Japanese petrochemical companies would have to be cut in half if the industry hopes to have enough muscle to compete with other industrialized nations. □